

Claims

1. A clamping device comprising a first clamping arm and a second clamping arm mounted for opening and closing to a body, an arm driving portion for displacing the first clamping arm to a clamping position and a non-clamping position, and a clamping force applying portion for applying a required clamping force to the clamping arm,

wherein the arm driving portion includes a first driving source for displacing the first clamping arm and a power transmission mechanism for transmitting a driving force from the first driving source to a rotary shaft of the first clamping arm and

the clamping force applying portion includes a pressing member for applying the clamping force to the first clamping arm by applying a rotating force in a clamping direction to the rotary shaft and a second driving source for displacing the pressing member from a non-operating position to an operating position for applying the clamping force.

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2. A clamping device according to claim 1, wherein the rotary shaft of the first clamping arm has a clamping force transmitting lever and the pressing member presses the transmitting lever to thereby apply the rotating force in the clamping direction to the rotary shaft.

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3. A clamping device according to claim 2, wherein a spring

force of a clamping spring is applied to the pressing member and the clamping force can be obtained by the spring force.

4. A clamping device according to claim 3, wherein a proximal  
5 end portion of the pressing member is rotatably mounted to a bracket, the bracket is mounted to the body with the clamping spring in between, and the spring force of the clamping spring is adjustable.

10 5. A clamping device according to claim 4, wherein the clamping spring is formed of a disc spring, the disc spring has a region in which the spring force is substantially constant with respect to flexure variation in a characteristic curve, and the spring force in the region is applied as the clamping force.

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6. A clamping device according to claim 1, wherein the second driving source is formed of an electromagnet, the electromagnet has an exciting coil and a core, and the pressing member is displaced to the operating position by an electromagnetic  
20 attracting force generated in the core by energization of the exciting coil.

7. A clamping device according to claim 2, wherein the power transmission mechanism and the rotary shaft are connected to each other with play of a certain angle maintained therebetween,  
25 the power transmission mechanism has a clamp releasing lever for causing the pressing member to recede from the operating

position to the non-operating position, and the clamp releasing lever rotates prior to the rotary shaft in a range of the play in releasing of clamping to thereby cause the pressing member to recede to the non-operating position where the pressing member

5 is detached from the transmitting lever.

8. A clamping device according to claim 7, wherein the power transmission mechanism includes a worm shaft driven by the first driving source and a wormwheel disposed coaxially with the rotary shaft, the worm wheel has the clamp releasing lever and one or more recessed groove(s) in a hole face of a central hole in which the rotary shaft is fitted, (an) engaging projecting portion(s) provided to an outer periphery of the rotary shaft being fitted in the recessed groove(s), and a groove width in a circumferential direction of each the recessed groove is formed to be larger than a width in the same direction of each the engaging projecting portion to thereby form the play.

9. A clamping device according to claim 2, wherein the pressing member has a rotatable roller in a position near a tip end of the member and is in contact with the transmitting lever at substantially right angles via the roller.

10. A clamping device according to claim 1,

25 wherein the rotary shaft of the first clamping arm has a clamping force transmitting lever and the pressing member presses the transmitting lever in clamping operation,

the pressing member is mounted to the body via a clamping spring to be able to incline and has a rotatable roller near a tip end portion, the roller in contact with the transmitting lever,

5       the power transmission mechanism includes a worm shaft and a worm wheel connected coaxially to the rotary shaft with play of a certain angle in a rotating direction maintained therebetween, the worm wheel has a clamp releasing lever for causing the pressing member to recede from the operating position  
10      to the non-operating position, and

the play performs a function of rotating the worm wheel prior to the rotary shaft in a range of the play in releasing of clamping to cause the pressing member to recede to a position where the pressing member is detached from the transmitting lever  
15      by the clamp releasing lever.

11. A clamping device according to claim 10, wherein the clamping spring is made of a disc spring, the disc spring has a region in which the spring force is substantially constant with respect  
20      to flexure variation in a characteristic curve, and the spring force in the region is applied as the clamping force.

12. A clamping device according to claim 10, wherein the first driving source is an electric motor, the second driving source  
25      is an electromagnet, the electromagnet has an exciting coil and a core, and the pressing member is displaced to the operating position by an electromagnetic attracting force generated in

the core by energization of the exciting coil.

13. A clamping device according to claim 11, wherein the first driving source is an electric motor, the second driving source 5 is an electromagnet, the electromagnet has an exciting coil and a core, and the pressing member is displaced to the operating position by an electromagnetic attracting force generated in the core by energization of the exciting coil.
- 10 14. A clamping device according to claim 10, wherein the worm wheel has one or more recessed groove(s) in a hole face of a central hole, (an) engaging projecting portion(s) provided to an outer periphery of the rotary shaft being fitted in the recessed groove(s) and a groove width in a circumferential direction of 15 each the recessed groove is formed to be larger than a width in the same direction of each the engaging projecting portion to thereby form the play.

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